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(54) Osteosynthesis device and preassembly method

Osteosynthesevorrichtung und Verfahren zur Vormontage

Dispositif d'ostéosynthèse et procédé de préassemblage

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- **PATENT ABSTRACTS OF JAPAN vol. 1997, no. 08, 29 August 1997 (1997-08-29) -& JP 09 098983 A (ROBAATO READ SHOKAI:KK), 15 April 1997 (1997-04-15)**

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Description

[0001] The present invention relates to an osteosynthesis device, particularly for spinal support or correction, enabling easier and compact implantation, that can be particularly used in the case of implantation via the anterior approach, and a preassembly method for such a device.

[0002] For spinal support or correction, a device comprising one or more support bars or plates positioned along the spinal column is used, and fixed to certain vertebrae by implants. Said implants are fixed at one end to the plate and at the other end to the vertebrae by bone anchorage means, for example a threaded part screwed inside the actual vertebra.

[0003] In such devices, it is known to use a plate comprising several holes, to join the implants fixed to several vertebrae, as described in the patent FR2726171, for example. Said bars then surround or pass through the head of the screw and are locked with a nut screwed onto said head.

[0004] However, such a device requires that the clamping nut only be fitted on the screw after the screws and the plate have been positioned. Therefore, said nut can only be inserted onto the screw head during the operation, with all the difficulties and risks of loss that may be caused by handling and assembling a small part inside a human body. This operation is all the more problematic when said operation is conducted by means of endoscopy, for example when it is necessary to implant via the anterior approach, i.e. via the front of the body or on the front face of the spine.

[0005] JP9098983 discloses a plate, one end only of which can be slid in already assembled fixation means of a spinal implant.

[0006] It is known in the patent WO 01 01874 a vertebral osteosynthesis plate for maintaining the correction of the relative orientation of vertebrae with a correcting instrument, said osteosynthesis plate being generally rectangular in shape and having four slots each allowing a fixing means to pass through. At least two slots opening onto a lateral edge of said osteosynthesis plate enable the plate to be set and fixed without prior withdrawal of the correcting instrument holding the relative orientation of the vertebrae. The preamble of claim 1 is based on the disclosure of this document.

[0007] Implants of such device are used for supporting a plate fixed to the vertebrae. The plate is in direct contact with the vertebrae and such contact may damage the vertebrae or may not allow the plate to lie in the desired orientation.

[0008] A device according to the prior art also requires that the implants be fixed and completely clamped before the plate is positioned. Therefore, in the event of delicate operative conditions, it is difficult to successfully position the plate very close to the spine. This problem arises for example when the shape of the spine comprises too many irregularities, due to spinal displacement or deformation or in the presence of outgrowths such as osteophytes. There are similar problems in the case of implantation by the anterior approach, i.e. via the front of the body or on the front face of the spine, Indeed, the anatomical conditions in this case frequently only leave space for a compact size. In addiction, it is often necessary to work by means of endoscopy in this case, which renders the operation difficult and gives a less satisfactory view of the implant insertion depth:

[0009] In some cases, to enable subsequent consolidation of the fixation between the implant and the vertebra, an implant composed of a so-called "rehabitable" screw is used, i.e. a hollow screw wherein the inside communicates with the outside via openings passing through the threaded wall. During the screwing into the vertebral, part of the bone substance penetrates inside the screw. Over time, the bone substance fuses between the inside and outside of the screw via these openings, thus forming consolidation over time.

[0010] In this way, the patent FR 2726171 discloses a hollow screw wherein the openings are produced by cutting on the inner surfaces of said screw longitudinal grooves which cut into the base of the outer threading. However, during positioning or subsequently, such a screw may form anchoring which is not sufficiently strong and is liable to be dislodged or torn from the vertebra wherein it is implanted.

[0011] One of the aims of the invention of the invention is to propose a plate that can be fitted on preassembled implants already screwed into the spine.

[0012] Another aim of the invention is to propose an osteosynthesis device that can be partly preassembled before the operation to enable easier implantation.

[0013] In this way, the invention relates to a device according to claim 1.

[0014] The dependent claims define embodiments having further aims and advantages.

[0015] One of these aims is to propose a compact osteosynthesis device, that can be fitted and adjusted in a position very close to the spine.

[0016] One of these advantages is to hold said plate without preventing the implant from rotating on its screwing axis, or without, preventing a specified clearance of the plate with respect to the implant, or both: thus making it possible to continue screwing the implant, or adjust the position of the plate; or both, after the plate has been assembled on the implant.

[0017] One of these aims is to propose an osteosynthesis device that can be screwed or clamped when it is not possible to use a tool in the actual axis of the implant.

[0018] One of these advantages is to make it possible to continue screwing the implant after the plate has been assembled on the implant, by rotating the clamping support around a clamping support axis, when said axis forms a non-null angle with the axis of the implant.

[0019] One of these aims is to propose an osteosynthesis device enabling improved screw implantation strength, during fitting, during the period prior to bone

fusion or after consolidation.

[0020] Another aim of the invention is to propose a preassembly method for such an osteosynthesis device.

[0021] This aim is achieved by the preassembly method for a device according to the invention, characterised in that it comprises the following steps:

- assembly of the plate support on the clamping support of an implant;
- assembly of the nut on the threading of the clamping support of said implant.

[0022] The invention, with its characteristics and advantages, will be seen more clearly upon reading the description with reference to the appended figures wherein:

- figures 1a, 1b, and 1c represent an osteosynthesis device according to the invention in an embodiment comprising an "H"-shaped plate and two polyaxial head implants fitted on an interval vertebra, in three successive phases of the fitting of the plate in the implants;
- figure 2 represents a longitudinal section view of an implant of a device according to the invention in the implant clamping phase after insertion of the plate, in an embodiment comprising a plate support free to rotate around a rehabitable hollow screw implant and fixed clamping support;
- figure 3 represents a longitudinal section view of an implant of a device according to the invention in the implant clamping phase after insertion of the plate, in an embodiment comprising a plate support free fo rotate around a rehabitable hollow screw implant and inclinable clamping support;
- figure 3a represents a partial view of an implant according to the invention, in a section along a plane passing through the centre of the support head and perpendicular to the support axis;
- figure 4 represents a longitudinal section view of an implant of a device according to the invention in the plate clamping phase once the implant is in its definitive position, in an embodiment comprising a plate support free to rotate around a rehabitable hollow screw implant and inclinable clamping support;
- figures 5a, 5b, 5c and 5d represent a top view of a plate of a device according to the invention, in an embodiment comprising a plate which is respectively "H"-shaped with two through openings, "h"-shaped with one through opening, with two non-through openings and with one non-through opening;
- figure 6 represents a side view of an implant of the preassembled device according to the invention, in an embodiment comprising an inclinable clamping support and a rehabitable hollow screw with two oblong holes;
- figure 7a represents a perspective view of a longitudinal section of an implant of a device according to the invention, in an embodiment comprising an inclinable clamping support and a rehabitable hollow screw with two oblong holes and according to an alternative embodiment where the screw head housing and the support head interact without being complementary in shape;
- figure 7b represents a partial perspective view of the support head of an implant of a device according to the invention in the same alternative embodiment;
- figure 7c represents a partial perspective view of a cross-section along the plane AA of an implant of a device according to the invention in the same alternative embodiment;
- figure 8 represents an osteosynthesis device according to the invention in an embodiment comprising an "H"-shaped plate and two polyaxial head implants according, to an alternative embodiment where the implants only comprise a single threaded part, on their outer surface.

[0023] In an embodiment represented in figure 2, the device according to the invention comprises an implant 1 comprising a first end 11 equipped with an outer threading 111, and is illustrated after a first screwing in the bone substance of a vertebra 0, after insertion of a plate 2 and during the final approach. Said first end 11 also comprises a cavity or an inner bore, itself equipped with an inner threading 112 wherein the screwing direction is the same as that of the outer threading 111. During the screwing of the implant into the vertebra 0, part of the bone substance tends to fill said cavity and is assisted therein by the action of the inner threading. Preferentially, the inner threading 112 and the outer threading 111 are of the same pitch, so as to minimise the strain exerted on the bone substance at the entry of the bore during screwing.

[0024] The wall between the inner cavity and the outside of the implant has one or more openings, referred to as bone fusion holes 110, in its part which is inside the vertebra after the clamping of the implant. In the periods following the implantation, generally approximately six months, the bone substance present outside and inside the implant tends to fuse. The fusing produced in this way improves the strength of said implantation, both by means of blocking via the bone fusion holes 110, and by means of cooperation of the inner threading 112 with the bone pin formed in this way.

[0025] In one alternative embodiment, the inner threading 112 has a greater pitch than that of the outer threading 111. During the screwing of the implant 1, the bone substance present inside the cavity is then attracted slightly more quickly than the implant progresses in the vertebra 0. This effect may make it possible to compensate for a filling defect liable to occur, for example by compression of the bone substance inside the bore. This effect may also make it possible to obtain more complete or more compact filling of said cavity, for example in order to obtain a specific compression or better filling, of the cavity or the bone fusion holes 110, and thus favour bone

substance fusion.

[0026] At its second end, i.e. opposite the vertebra, the implant 1 comprises fixation means used to insert, hold and finally clamp a bar or a plate 2. Said second end also comprises drive means using a tool of known type, such as a hexagonal recess 124.

[0027] Said fixation means comprise for example an elongated part 12a of a cross-section less than the central part of the implant, comprising a shoulder. Said elongated part 12a passes through a plate support 3 resting on said shoulder, and comprises at its end a threading 123 receiving a clamping nut 4. In one embodiment, said plate 2, figure 5a, is roughly "H"-shaped, comprising for example two cylindrical bars joined at their centre by a rigid distance sleeve. In an alternative embodiment, the two bars are joined by a non-rigid joint enabling more latitude in the positioning of the plate. Said plate 2 is inserted between the plate support 3 and the nut 4, so as to surround the elongated part 12a of the implant. Once the plate is in position, the nut 4 is fastened, by hand or using a tool of a known type 52, figure 4, and cooperates with the threading 123 to clamp the plate 2 against the plate support 3 and thus lock the fixation.

[0028] In said embodiment, the plate support 3 comprises a bore 30 with a roughly rectangular insert passing through its centre. Said plate support 3, on the side of the plate, has one or more roughly complementary surfaces 32 to the surface of the plate 2 resting on them. In said embodiment, the central bore of the plate support 3 is sufficiently larger than the part 12a passing through it to allow a clearance of said support 3 transversally and at an angle with respect to the axis d1 of the implant. Said clearance makes it possible to adjust the relative position of the plate supports of two implants 1, 1a easily, and thus insert the plate 2 easily even if the implants are not well aligned or in the event of a relatively inaccessible anatomical environment. According to an alternative embodiment not shown, the plate support receives a plate 2a, figure 5b, comprising a single bar at one of its ends. Said plate support can then comprise an offset bore instead of the central bore 30, without leaving the scope of the invention.

[0029] Since the plate support 3 is free in rotation around the part 12a of the implant 1, it is clearly understood that it is possible to continue screwing said implant into the vertebra 0, even when the plate is already in position, provided that the fixation means are not fastened on said plate 2. In this way, by inserting the plate 2 into said fixation means before the implant 1 is not entirely screwed on, it is possible not to be hindered by the various differences in levels or outgrowths liable to be present in the immediate vicinity of the spine. Once the plate is held in place but not clamped, it is still possible to finish screwing the implant into the vertebra, by rotating it via an opening of the plate support 3. The fixation means then hold the plate 2 close to the spine, the screwing of the implant providing sufficient force to oblige the plate to come closer to the spine. Therefore, the plate can be positioned and inserted with little effort, while being positioned definitively very close to the surface of the vertebra, which makes it possible to obtain a compact device size once fitted.

[0030] In a preferential embodiment of the device according to the invention, represented in figures 3, 3a and 4, the implant 1 comprises a mobile part, referred to as the clamping support 12, at its second end opposite the first end 11 screwing into the vertebra 0. Said clamping support 12 has an elongated first end 121 along a support axis d12. Said elongated end passes through the central bore of the plate support 3 and bears a threading 123 receiving the camping nut 4.

[0031] At a second end opposite its elongated end 121, the clamping support 12 bears a part, referred to as the support head 122, joining said clamping support 12 to the implant, by its second end, referred to as the screw head 102, opposite the end 11 screwed into the vertebra 0. Along a plane perpendicular to the support axis d12, said clamping support head 122 has at least one dimension s122; figure 3a, greater than at least one cross-section s121 of the elongated end 121 of said clamping support 12. Said support head 122 is retained in a housing provided in the screw head 102 of the implants 1. For this purpose said housing has an opening of a specified size s102 so as to retain the support head 122 inside said housing, while allowing a clearance of a specified angle a between the support axis d12 and the implant axis d1.

[0032] Said angular clearance of the clamping support 12 with respect to the implant enables angular and lateral movements facilitating to the insertion of the plate in the fixation means of the implant, as described below. Said angular clearance also makes it possible to compensate for any alignment defects between the different implants 1, 1a; figure 1c, of a device according to the invention and therefore renders the positioning of the plate 2 in the fixation means of said implants less delicate.

[0033] In said preferential embodiment, the plate support 3 rests on the screw head 102 of the implant 1, by means of a lower surface 31 composing a spherical portion for example. Said lower surface 31 of the plate support is in complementary contact with an upper surface 13 of said screw head. Said spherical complementary contact allows freedom of rotation and inclination of the plate support 3 with respect to the implant 1. Said spherical complementary contact of said surfaces 13, 31 also enables a uniform and stable support of said surfaces with respect to each other, after the plate 2 has been clamped onto the plate support, irrespective of the definitive angular position of said plate support 3 or the clamping support 12.

[0034] The implant 1 is screwed into the vertebra 0 by means of a rotational drive of said implant by rotating the clamping support 12 around its own clamping axis d12. Said clamping support is rotated for example by a tool, of known type, inserted into at least one recess 124 contained in the elongated end 121 of said clamping support.

The clamping support 12 rotates the implant 1 by means of a universal type joint, i.e. the rotation of either of the two components around its axis rotates the other component around its own axis, the angle between the two axes possibly being non-null.

[0035] Said universal joint is produced by the cooperation of the outer surface 120 of the support head 122 with the inner surface 100 of the housing of the screw head 102 of the implant 1. Along a plane perpendicular to the support axis d12, the support head 12 has a section with a non-circular outline, for example in the shape of a star or cross with rounded corners, as illustrated in figure 3a. The housing of the screw head 102 which receives the support head 122, then has an inner surface 100 in roughly complementary contact with the outer surface 120 of said support head 122, said two surfaces 100, 120 cooperating to form the rotational join between these two components 102, 122. The angular variation is allowed by the fact that the support head 122, and its complementary housing, have a section with a circular outline along at least one plane including the clamping support axis d12, or the implant axis d1, or both.

[0036] According to an alternative embodiment illustrated in figures 7a to 7c, the inner surface 100 of the screw head housing receiving the support head simply has one or more projecting parts 100a, for example two. The outer surface 120 of the support head 122 then has one or more concave parts 120a with which the projecting parts 100a of the screw head housing cooperate to prevent the rotation of the clamping support 12 around its axis d12.

[0037] In this way, it is clear that it is possible to continue screwing the implant 1 into the vertebra 0, while the plate 2 is already inserted between the clamping nut 4 and the plate support 3, by adjusting the elongated end 121 of the clamping support 12 accessible via the nut 4. Since the plate support 3 is free to rotate with respect to the implant 1, said implant can rotate during screwing while leaving the plate 2 and the plate support 3 immobile.

[0038] Once the implant 1 is completely screwed into the vertebra 0, as illustrated in figure 4, the plate 2 can then be adjusted and locked in its definitive position, by tightening the clamping nub4. Said nut may be tightened by hand, for example on a knurled part of its outer surface on the support axis d12, or using a tool 52 of known type, for example by adjusting two inner or outer recesses on the nut.

[0039] According to an alternative embodiment illustrated in figure 8, a device according to the invention uses such implants but wherein the end 11 intended to be anchored in the vertebra only comprises one outer threaded part 111. In said alternative embodiment, the implant may comprise a longitudinal bore passing through it from one end to another, to enable positioning by means of sliding around a pin implanted beforehand in the vertebra.

[0040] Several implants according to various alternative embodiments in the same device can of course be combined without leaving the scope of the invention.

[0041] Depending on the applications, in order to join two implants 1, 1a; figure 1c, it is possible to use a plate of different configurations, for example such as those represented in figures 5a, 5b, 5c and 5d.

[0042] In the example of an embodiment illustrated in figures 1a, 1b, and 1c, two implants 1, 1a are screwed into the body of two vertebrae 0, 0a respectively of the spine, spaced by an interval of one vertebra. These two implants are then fixed together by a plate 2 inserted into their fixation means around the clamping support and then clamped between the plate support and the nut of each of said implants.

[0043] In the preferential embodiment represented in figure 5a, the plate 2 is elongated in shape and comprises two roughly parallel bars 201, 202, which are for example cylindrical, joined together in a rigid or flexible manner by a joining part 20. Said joining part joins the two bars at an inner part of the plate, i.e. at a specified non-null distance from each of the ends 21, 22 of the plate. More specifically, said joining part is located at a sufficient distance from each end of the plate so that said end can be inserted into the fixation means of an implant, and possibly slide in said fixation means. The position of said joining part 20 may be located at the centre of the plate, or be offset to allow a greater clearance for sliding during insertion as explained below.

[0044] At each end 21, 22 respectively, of the plate 2, the space between the two bars forms an opening 210, 220 respectively, opening out onto the edge of the plate. Said openings have a roughly constant transversal gap s211, s221, enabling longitudinal sliding of the plate in the fixation means of an implant 1,1a. This roughly constant transversal gap also makes it possible to clamp said fixation means in any part of said openings 210, 220. Since said openings open onto the edge of the plate, it is possible to insert each of the ends of the plate into the fixation means of an implant 1, 1a as illustrated in figure 1a, without having to remove the nut 4 if it was preassembled beforehand. At each end, this insertion consists of sliding the end of the two bars between the nut 4 and the plate support 3 of the implant 1, at either side of the clamping support 12.

[0045] In another embodiment represented in figure 5b, the plate 2a is elongated in shape and comprises a first end 21 a comprising a single bar, which is cylindrical for example. Said first end can be inserted into an implant according to the prior art or into an implant as described in the present invention, for example in an alternative embodiment (not shown) where the plate support only comprises a single surface 32 in contact with the plate. The plate 2a also has a second end 22a comprising two roughly parallel bars, which are cylindrical for example. These two bars form a longitudinally elongated opening 220a together, of a roughly constant width s221 a. Either of the two ends of said plate 2a can be inserted, or slide, or both, in the fixation means of an implant according to the invention, in the manner described in the preferential embodiment.

[0046] In another embodiment represented in figure 5c, the plate 2b is elongated in shape and comprises a first end 21 b having at least one opening 210b and a second end 22b having at least one second opening 220b, at least one of these openings not opening onto the edge of the plate 2b. These two openings 210b, 220b have a longitudinally elongated shape, i.e. along the length of the plate, and may be separated by one or more joining parts 20. These two openings have a roughly constant width s211b, s221b, and can be positioned by means of sliding and then be clamped in the fixation means of the implants. At least one of said openings has a part, referred to as a notch, of a larger size s210b, s220b, of a shape and size able to allow the nut 4 of the fixation means of an implant to pass through. Therefore, such a bar 2b can also be inserted in the fixation means of an implant 1 when said fixation means are already assembled, therefore not requiring handling, in the patient's body, of smart parts such as the nut 4 or the plate support 3.

[0047] In an alternative embodiment represented in figure 5d, the plate 2c has a single opening comprising two notches as described above (see figure 5c). In an embodiment not shown, the plate may comprise a sufficient number of openings and notches to be able to assemble the plate with more than two implants.

[0048] It is clear that these, different types of openings, which are either through or have a wider part, can be combined in various ways without leaving the scope of the invention.

[0049] In the same way, the position of the joining part 20 can vary and be offset along the length of the plate, so as to leave the clearance required for the plate to slide during positioning. In a preferential embodiment, said position is slightly offset with respect to the centre of the plate, so as to be able to slide the plate sufficiently in the first implant 1; figure 1b, to be able to insert it into the second implant 1 a.

[0050] It is necessary to understand here that the device described can equally well comprise any other combination of different alternative embodiments of plates and alternative embodiments of implants without leaving the scope of the invention.

[0051] Figures 1a, 1b, and 1c illustrate different steps in the positioning of the plate 2 in two implants 1, 1 a, in the preferential embodiment. This positioning is carried out while the implants are already screwed into the spine, their fixation means, in this case the plate support 3 and the nut 4 being already assembled on the implant but not clamped.

[0052] In this way, in figure 1a, a first end 21 of the plate 2 is inserted in the fixation means of the first implant 1, on the plate support 3 and under the nut 4, straddled around the clamping support 12.

[0053] Once this first end 21 has been inserted, due to the fact that the bars have a roughly constant gap, it is possible to slide the plate in the fixation means of the first implant 1 until the second end 22 of the plate can be aligned (figure 1 b) in front of the fixation means of the second implant 1 a.

[0054] By sliding the plate in the opposite direction, it is then possible to insert (figure 1c) said second end 22 in a similar manner in the fixation means of the second implants 1 a. It is them possible to adjust the definitive position of the plate 2 and tighten the nut of the fixation means of each of the two implants, and thus stiffen the assembly.

[0055] In this way, it is clear that it is possible to prepare the osteosynthesis device in advance using the preassembly method, comprising the following steps:

- assembly of the plate support 3 around the clamping support;
- assembly of the nut 4 on the threading 123 of the clamping support.

[0056] Once it has been preassembled using this method, an implant 1 of the device according to the invention can be used directly during the surgical operation, as represented in figure 6.

[0057] The osteosynthesis device can then be positioned using the following steps:

- the implants are screwed into the spine, without inserting them to the definitive depth. This approach position makes it possible not to be hindered by any osteophytes when positioning the plate 2.
- The plate 2 is inserted via a first end 21 into a first implant 1. It is then slid into said first implant to be presented in front of the fixation means of the second implant 1a. The second end 22 is then inserted into the second implant. This positioning is illustrated in figures 1a, 1b, and 1c.

[0058] At this stage and subsequently, the clearance of the plate support 3 around the clamping support 12 allows the angular and lateral movements required for insertion. This clearance also makes it possible to compensate for any alignment defects between the two implants 1, 1a, and thus renders the positioning of the plate 2 less delicate.

- The screwing of the two implants into the spine is then completed until they are clamped in their definitive position. This screwing is performed (figure 3) using a tool of known type rotating the implant by means of a rotation of the clamping support 12. Since the plate 2 is already in position and held in place by the fixation means of the implants, this additional screwing of the implants drives the plate to its definitive position close to the spine. Therefore, this driving obtained by screwing the implants makes it possible to reduce the size determined by said plate, by tightening or inlaying said plate firmly and easily on the surface of the spine.
- Once the implants have been completely screwed

on, the plate is locked in the fixation means of the implants, by clamping (figure 4) their nut 4 on the plate 2 itself resting on the plate support 3 which rests on the shoulder or on the screw head 102 of the implant. Naturally, said clamping may be carried out using other parts not mentioned, such as washers or locking devices of known types.

[0059] It must be clear to those skilled in the art that the present invention enables other embodiments in numerous other specific forms without leaving the scope of the invention as claimed. As a result, the present embodiments must be considered as illustrations, but may be modified in the field defined by the scope of the fixed claims, and the invention must not be restricted to the details given above.

Claims

1. Osteosynthesis device, particularly for the spine, comprising at least one plate or bar, hereafter called plate (2, 2a, 2b, 2c), fixation means (3, 4) and a plurality of implants (1, 1 a) having an elongated shape around an axis, referred to as the implant axis (d1), comprising a first bone anchoring end (11) bearing at least one threading (111) that can be screwed into one or more vertebrae (0) and provide, by said fixation means (3, 4) joining the plate (2, 2a, 2b, 2c) to the implants (1, 1 a), a rigid joint between said vertebrae and said plate (2, 2a, 2b, 2c) so as to hold or displace the spine, wherein the plate (2, 2a, 2b, 2c) has an elongated shape and comprises, at at least one of its ends, at least one longitudinally elongated opening, said opening having, firstly, at least one part (s211, s221, s221 a) opening onto an edge of the plate (2, 2a, 2b, 2c) to be able to insert said part (s211, s221, s221 a) in said fixation means (3, 4), or one part of a sufficiently large size (s210b) to be able to insert said fixation means (3, 4) in said part (s210b), without disassembling said fixation means (3, 4) of an implant (1, 1 a) already screwed into the spine, when said fixation means (3, 4) are already assembled, and, secondly, one part of a roughly constant width (s211, s221, s221a, s211 b, s221b) and enabling the plate (2, 2a, 2b, 2c) to slide longitudinally within the fixation means (3, 4) of said implant (1, 1 a) after having been inserted and of being fixed; so that said plate (2, 2a, 2b, 2c) can be assembled by one end to an already fitted implant (1, 1 a), and then slide in the fixation means (3, 4) of said implant (1, 1a) to insert the other end of said plate (2, 2a, 2b, 2c) onto another already screwed implant (1, 1 a), and then slide again to bring both ends into a fixation position, while the fixation means (3, 4) of said two implants (1, 1 a) were assembled before being fitted onto the spine, **characterised in that** the fixation means (3, 4) comprise clamping means (4) and a plate support (3), said implants (1, 1 a) comprising a second end with an elongated part second end with an elongated part, referred to as the clamping support (12, 12a), passing through the plate support (3), said plate support (3) being free in rotation around said elongated part (12, 12a) which bears said clamping means (4) able to clamp the plate (2, 2a, 2b, 2c) against said plate support (3) (12, 12a) passing through the plate support (3), said plate support (3) being free in rotation around said elongated part (12, 12a) which bears said clamping means (4) able to clamp the plate (2, 2a, 2b, 2c) against said plate support (3).

2. Device according to the above claim, **characterised in that** the plate (2a) comprises two parts (201, 202) of identical lengths or not, said two parts being joined together by a joining part (20, 20a, 20b), said joining part being located in an inner part of the plate, i.e. at a sufficient distance from the ends to enable the fixation of the plate onto two implants (1, 1a), at a rate of one implant on either side of said joining part.

3. Device according to claim 2, **characterised in that** the joining part (20, 20a, 20b) is located in a position offset with respect to the centre of the plate length.

4. Device according to any of the above claims, **characterised in that** the plate has an "H" or "h" shape.

5. Device according to any of the above claims, **characterised in that** the plate (2b) has at least one longitudinally elongated opening (210, 210b, 220a 220a, 220b), wherein a first region is of constant width (s211 b, s221 b) and a second region is larger in size (s210b) than the first region, said opening 210, 210b, 220a 220a, 220bbeing able to allow the fixation means of an implant to pass before sliding to bring said fixation means in the first region.

6. Device according to any of the above claims, **characterised in that** the plate is joined to at least one implant by said fixation means able to hold said plate without preventing the implant from rotating on its screwing axis, or without preventing a specified clearance of the plate with respect to the implant, or both; thus making it possible to continue screwing the implant, or adjust the position of the plate, or both, after the plate has been assembled on the implant.

7. Device according to any of the above claims, **characterised in that** said clamping support (12), of the implant (1, 1 a) is mobile with respect to the rest of the implant, along a universal type joint between a part of the implant referred to as the screw head (102) and a part of the clamping support referred to as the support head (122), thus making it possible to con-

tinue screwing the implant after the plate (2, 2a, 2b, 2c) has been assembled on the implant, by rotating the clamping support around a clamping support axis (d12), when said axis (d12) forms a non-null angle (a) with the axis (d1) of the implant.

8. Device according to claim 7, **characterised in that** the plate (2, 2a, 2b, 2c) surrounds the clamping support (12, 12a) or the second end (12a) of the implant (1, 1 a) at least partly and rests on a shoulder (32) of its complementary plate support (3), said plate support having on the implant side a concave surface (31) in the form of a spherical portion which is supported in a complementary fashion on the outer surface of the implant screw head (102).

9. Device according to any of the claims 7 and 8, **characterised in that** the clamping support (12) has a first elongated end (121) along the support axis (d12) and a second end bearing the support head (122), said support head having a non-circular cross-section having at least one concave part (120a) and comprising at least one dimension greater than at least one cross-section (s121) of the first end of the clamping support (12); said support head (122) having firstly one section roughly partly circular along a plane including the support axis (d12), and being secondly arranged in the screw head (102) inside a housing wherein the inner surface (100) has at least one projecting part (100a) cooperating with the concave part (120a) of the support head (122) to prevent rotation of the clamping support (12) around its axis (d12).

10. Device according to claim 9, **characterised in that** the inner surface (100) of the screw head housing (102) has a shape roughly complementary to the outer surface (120) of the support head (122).

11. Device according to any of the claims 7 to 10, **characterised in that** the housing receiving the support head (122) has, on the side of said clamping head, a specified dimension (s102) to allow the clamping support (12) a clearance along a specified angle (a), between the axis (d12) of the clamping support and the axis (d1) of the implant, without said clamping support (12) escaping from said housing.

12. Device according to any of the claims 7 to 11, **characterised in that** the support head (122) has a star-shaped cross-section with rounded ends, along a plane perpendicular to the support axis (d12).

13. Device according to any of the above claims, **characterised in that** the clamping support clamping means (12) comprise a threading (123) cooperating with a nut (4) to hold or clamp the plate (2, 2a, 2b, 2c) against the plate support (3).

14. Device according to any of the above claims, **characterised in that** the clamping support (12) comprises at its end opposite the implant an inner or outer recess (124) capable of receiving a rotational drive tool (51) and thus enable the screwing or clamping of the implant in the vertebra (0).

15. Device according to any of the above claims, **characterised in that** the first bone anchorage end (11) of at least one implant (1, 1 a) has a longitudinal bore concentric to its outer surface, said bore communicating with the outside by at least one bone fusion opening (110) produced in the wall between said inner bore and said outer surface, thus enabling a fusion between the inside and the outside of the bone substance in contact with said first end (11).

16. Device according to any of the above claims, **characterised in that** the first bone anchorage end (11) of at least one implant (1, 1 a) has two threadings (111, 112) winding in the same direction during the screwing of the implant, and borne respectively by the outer surface of said first end and the inner surface of the bore that it comprises.

17. Device according to any of the above claims, **characterised in that** at least one bone fusion opening (110) has the shape of a longitudinal oblong hole.

18. Device according to any of the above claims, **characterised in that** the bore of the support plate (3) through which the clamping support (12, 12a) passes is larger than the latter, so as to allow clearance of the bar, at least when the clamping means (4) are loosely clamped.

19. Preassembly method for a device according to any of claims 1 to 18, **characterised in that** it comprises the following steps:

- assembly of the plate support (3) on the clamping support (12a, 12) of an implant (1, 1a);
- assembly of the nut (4) on the threading (123) of the clamping support (12a, 12) of said implant.

Patentansprüche

1. Osteosynthesevorrichtung, insbesondere für die Wirbelsäule, aufweisend mindestens eine Platte oder Stange, die nachfolgend als Platte (2, 2a, 2b, 2c) bezeichnet wird, Fixierungsmittel (3, 4) und eine Mehrzahl von Implantaten (1, 1a), die um eine als die Implantationsachse (d1) bezeichnete Achse herum eine längliche Form haben, die aufweisen: ein erstes Knochenverankerungsende (11), das mindestens ein Gewinde (111) trägt, das in einen oder mehr Wirbel (0) hineingeschraubt werden und mit-

tels der Fixierungsmittel (3, 4), die die Platte (2, 2a, 2b, 2c) an die Implantate (1, 1a) anfügen, eine steife Verbindung zwischen den Wirbeln und der Platte (2, 2a, 2b, 2c) bereitstellen kann, um die Wirbelsäule zu halten oder zu bewegen, wobei die Platte (2, 2a, 2b, 2c) eine längliche Form aufweist und an mindestens einem ihrer Enden mindestens eine in Längsrichtung längliche Öffnung aufweist, wobei die Öffnung aufweist: erstens mindestens einen Teil (s211, s221, s221 a), der sich zu einem Rand der Platte (2, 2a, 2b, 2c) hin öffnet um den Teil (s211, s221, s221 a) in die Fixierungsmittel (3, 4) einfügen zu können, oder einen Teil mit einer ausreichend großen Größe (s210b), um die Fixierungsmittel (3, 4) in den Teil (s210b) einfügen zu können, ohne die Fixierungsmittel (3, 4), eines bereits in die Wirbelsäule geschraubten Implantat (1, 1a), auseinanderbauen zu müssen, wenn die Fixierungsmittel (3, 4) zusammengebaut sind, und zweitens einen Teil mit einer etwa konstanten Breite (s211, s221, s221 a, s211b, s221b), der ferner der Platte (2, 2a, 2b, 2c) ermöglicht, innerhalb der Fixierungsmittel (3, 4) des Implantates (1, 1a) in Längsrichtung zu gleiten, nachdem er eingesetzt wurde, und daran fixiert zu werden, so dass die Platte (2, 2a, 2b, 2c) mit einem Ende an einem bereits angebrachten Implantat (1, 1a) montiert werden und dann in die Fixierungsmittel (3, 4) des Implantats (1, 1 a) gleiten kann, um das andere Ende der Platte (2, 2a, 2b, 2c) in die Fixierungsmittel eines anderen bereits angebrachten Implantats (1, 1a) einzufügen, und dann erneut gleiten kann, um beide Enden in eine Befestigungsposition zu bringen, wobei die Fixierungsmittel (3, 4) der beiden Implantate (1, 1 a) bereits montiert wurden, bevor sie an der Wirbelsäule angebracht wurden, **dadurch gekennzeichnet, dass** die Fixierungsmittel (3, 4) Klemm-Mittel (4) und eine Plattenstütze (3) aufweisen, wobei die Implantate (1, 1a) ein zweites Ende mit einem länglichen Teil aufweisen, der als Klemmstütze (12, 12a) bezeichnet wird, der durch die Plattenstütze (3) hindurchverläuft, wobei die Plattenstütze (3) um den länglichen Teil (12, 12a) herum, der das zum Klemmen der Platte (2, 2a, 2b, 2c) gegen die Plattenstütze geeignete Klemm-Mittel (4) trägt, frei drehbar ist.

2. Vorrichtung gemäß dem obigen Anspruch, **dadurch gekennzeichnet, dass** die Platte (2a) zwei Teile (201, 202) aufweist von gleicher Länge oder nicht, wobei die beiden Teile durch einen Verbindungsteil (20, 20a, 20b) aneinandergefügt sind, wobei der Verbindungsteil in einem inneren Teil der Platte, das heißt in einem ausreichenden Abstand von den Enden positioniert ist, um das Fixieren der Platte an zwei Implantaten (1, 1a) in einem Verhältnis von einem Implantat auf jeder Seite des Verbindungsteils zu ermöglichen.

3. Vorrichtung gemäß Anspruch 2, **dadurch gekennzeichnet, dass** der Verbindungsteil (20, 20a, 20b) in einer relativ zu der Mitte der Plattenlänge versetzen Position positioniert ist.

4. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Platte eine "H"- oder "h"-Form aufweist.

5. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Platte (2b) mindestens eine in Längsrichtung längliche Öffnung aufweist, wobei ein erster Bereich eine konstante Breite (s221b) aufweist und ein zweiter Bereich eine größere Größe (s210b) als der erste Bereich aufweist, wobei die Öffnung () geeignet ist, die Fixierungsmittel eines Implantats vor dem Gleiten hindurchpassieren zu lassen, um die Fixierungsmittel in den ersten Bereich zu bringen.

6. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Platte durch die Fixierungsmittel an mindestens ein Implantat angefügt ist, die geeignet sind, die Platte zu halten, ohne zu verhindern, dass sich das Implantat auf seiner Schraubachse dreht oder ohne ein bestimmtes Spiel der Platte relativ zu dem Implantat zu verhindern, oder beides, wodurch ermöglicht wird, mit dem Schrauben des Implantats oder dem Anpassen der Position der Platte oder beidem fortzufahren, nachdem die Platte an dem Implantat montiert wurde.

7. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Klemmstütze (12) des Implantats (1, 1a) relativ zu dem Rest des Implantats entlang einem Gelenk des Universaltyps zwischen einem als Schraubenkopf (102) bezeichneten Teil des Implantats und einem als Stützkopf (122) bezeichneten Teil der Klemmstütze bewegbar ist, wodurch ermöglicht wird, mit dem Schrauben des Implantates fortzufahren, nachdem die Platte (2, 2a, 2b, 2c) an dem Implantat montiert wurde, durch Drehen der Klemmstütze um eine Klemmstützenachse (d12), wenn die Achse (d12) mit der Achse (d1) des Implantats einen Winkel ungleich Null (a) bildet.

8. Vorrichtung gemäß Anspruch 7, **dadurch gekennzeichnet, dass** die Platte (2, 2a, 2b, 2c) die Klemmstütze (12, 12a) oder das zweite Ende (12a) des Implantats (1, 1a) zumindest teilweise umgibt und auf einer Schulter (32) ihrer komplementären Plattenstütze (3) aufliegt, wobei die Plattenstütze auf der Implantatseite eine konkave Fläche (31) in der Form eines sphärischen Abschnitts aufweist, der an der Außenfläche des Implantatschraubenkopfes (102) auf komplementäre Weise abgestützt ist.

9. Vorrichtung gemäß irgendeinem der Ansprüche 7 und 8, **dadurch gekennzeichnet, dass** die Klemmstütze (12) ein erstes längliches Ende (121) entlang der Stützachse (d12) und ein den Stützkopf (122) tragendes zweites Ende aufweist, wobei der Stützkopf einen nicht kreisförmigen Querschnitt aufweist, der mindestens einen konkaven Teil (120a) aufweist und mindestens eine Abmessung aufweist, die größer als mindestens ein Querschnitt (s121) des ersten Endes der Klemmstütze (12) ist, wobei der Stützkopf (122) erstens einen Schnitt aufweist, der entlang einer die Stützachse (d12) aufweisenden Ebene teilweise etwa kreisförmig ist, und zweitens in dem Schraubenkopf (102) innerhalb eines Gehäuses angeordnet ist, wobei die Innenfläche (100) mindestens einen hervorstehenden Teil (100a) aufweist, der mit dem konkaven Teil (120a) des Stützkopfes (122) zusammenwirkt, um ein Drehen der Klemmstütze (12) um ihre Achse (d12) zu verhindern.

10. Vorrichtung gemäß Anspruch 9, **dadurch gekennzeichnet, dass** die Innenfläche (100) des Schraubenkopfgehäuses (102) eine Form aufweist, die etwa komplementär zu der Außenfläche (120) des Stützkopfes (122) ist.

11. Vorrichtung gemäß irgendeinem der Ansprüche 7 bis 10, **dadurch gekennzeichnet, dass** das Gehäuse, das den Stützkopf (122) aufnimmt, auf der Seite des Klemmkopfes eine bestimmte Abmessung (s102) aufweist, um der Klemmstütze (12) ein Spiel entlang einem bestimmten Winkel (a) zwischen der Achse (d12) der Klemmstütze und der Achse (d1) des Implantats zu erlauben, ohne die Klemmstütze (12) aus dem Gehäuse herausgelangt.

12. Vorrichtung gemäß irgendeinem der Ansprüche 7 bis 11, **dadurch gekennzeichnet, dass** der Stützkopf (122) einen sternförmigen Querschnitt mit abgerundeten Enden entlang einer Ebene senkrecht zu der Stützachse (d12) aufweist.

13. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Klemmstützen-Klemm-Mittel (12) ein Gewinde (123) aufweisen, das mit einer Mutter (4) zusammenwirkt, um die Platte (2, 2a, 2b, 2c) gegen die Plattenstütze (3) zu halten oder zu klemmen.

14. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Klemmstütze (12) an ihrem dem Implantat entgegengesetzten Ende eine innere oder äußere Aussparung (124) aufweist, die geeignet ist, ein Drehantriebswerkzeug (51) aufzunehmen und somit das Schrauben oder Klemmen des Implantates in den Wirbel (0) zu ermöglichen.

15. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** das erste Knochenverankerungsende (11) des mindestens einen Implantats (1, 1a) ein zu seiner Außenfläche konzentrisches Längsbohrloch aufweist, wobei das Bohrloch durch mindestens eine in der Wand zwischen der inneren Bohrung und der Außenfläche erzeugte Knochenfusionsöffnung (110) mit dem Äußeren kommuniziert, wodurch eine Fusion zwischen dem Inneren und dem Äußeren der Knochensubstanz in Kontakt mit dem ersten Ende (11) ermöglicht wird.

16. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** das erste Knochenverankerungsende (11) mindestens eines Implantats (1, 1a) zwei Gewinde (111, 112) aufweist, die während des Schraubens des Implantats in der gleichen Richtung gewunden sind, und die jeweils von der Außenfläche des ersten Endes und der Innenfläche des Bohrlochs getragen werden, das es aufweist.

17. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** mindestens eine Knochenfusionsöffnung (110) die Form eines in Längsrichtung länglichen Lochs aufweist.

18. Vorrichtung gemäß irgendeinem der obigen Ansprüche, **dadurch gekennzeichnet, dass** das Bohrloch der Stützplatte (3), durch das die Klemmstütze (12) hindurchpassiert, größer als letztere ist, um ein Spiel der Stange zumindest dann zu ermöglichen, wenn die Klemm-Mittel (4) locker geklemmt sind.

19. Vormontageverfahren für eine Vorrichtung gemäß irgendeinem der Ansprüche 1 bis 18, **dadurch gekennzeichnet, dass** es die folgenden Schritte aufweist:

- Montieren der Plattenstütze (3) an der Klemmstütze (12a, 12) eines Implantats (1, 1a),
- Montieren der Mutter (4) an dem Gewinde (123) der Klemmstütze (12a, 12) des Implantats.

Revendications

1. Dispositif d'ostéosynthèse, en particulier pour le rachis, comprenant au moins une plaque ou barre, ci-après dénommée plaque (2, 2a, 2b, 2c), des moyens de fixation (3, 4) et une pluralité d'implants (1, 1a) ayant une forme allongée autour d'un axe, désigné sous le terme d'axe d'implant (d1), comprenant une première extrémité d'ancrage osseux (11) portant au moins un filetage (111) qui peut être vissé dans une ou plusieurs vertèbres (0) et fournissent, grâce auxdits moyens de fixation (3, 4) reliant la plaque (2,

2a, 2b, 2c) aux implants (1, 1a), un joint rigide entre lesdites vertèbres et ladite plaque (2, 2a, 2b, 2c) afin de maintenir ou de déplacer le rachis, dans lequel la plaque (2, 2a, 2b, 2c) a une forme allongée et comprend, au niveau d'au moins l'une de ses extrémités, au moins une ouverture longitudinalement allongée, ladite ouverture ayant, premièrement, au moins une partie (s211, s221, s221a) débouchant sur un bord de la plaque (2, 2a, 2b, 2c) pour pouvoir insérer ladite partie (s211, s221, s221a) dans les moyens de to be able to insert said part (s211, s221, s221 a) fixation (3, 4) ou bien une partie d'une taille suffisamment grande (s210b) pour insérer les moyens de fixation (3, 4) dans ladite partie (s210b), sans désassembler lesdits moyens de fixation (3, 4) d'un implant (1, 1a) déjà vissé dans le rachis, lorsque les moyens de fixation (3, 4) sont déjà assemblés, et deuxièmement, une partie d'une largeur à peu constante (s211, s221, s221 a, s211 b, s221 b) et permettant à la plaque (2, 2a, 2b, 2c) de coulisser longitudinalement dans les moyens de fixation (3, 4) dudit implant (1, 1a) après avoir été insérée et été fixée ; de sorte que ladite plaque (2, 2a, 2b, 2c) peut être reliée par une extrémité sur un implant (1, 1a) déjà installé et ensuite coulisser dans les moyens de fixation (3, 4) dudit implant (1, 1a) pour insérer l'autre extrémité de ladite plaque (2, 2a, 2b, 2c) sur un autre implant (1, 1 a) déjà vissé, et ensuite coulisser à nouveau pour amener les deux extrémités dans une position de fixation, alors que les moyens de fixation (3, 4) desdits deux implants (1, 1a) ont été avant d'être sur le rachis, **caractérisé en ce que** les moyens de fixation (3, 4) comprennent des moyens de serrage (4) et un support de plaque (3), lesdits implants (1, 1 a) comprenant une deuxième extrémité avec une partie allongée, dite support de serrage (12, 12a), passant par le support de plaque (3), ledit support de plaque (3) étant libre en rotation autour de ladite partie allongée (12, 12a) qui porte lesdits moyens de serrage (4) pouvant serrer la plaque (2, 2a, 2b, 2c) contre ledit support de plaque (3).

2. Dispositif selon la revendication précédente, **caractérisé en ce que** la plaque (2a) comprend deux parties (201, 202) de longueurs identiques ou pas, lesdites deux parties étant reliées par une partie de liaison (20, 20a, 20b), ladite partie de liaison étant située dans une partie interne de la plaque, c'est-à-dire à une distance suffisante des extrémités pour permettre la fixation de la plaque sur deux implants (1, 1a), à raison d'un implant de chaque côté de ladite partie de liaison.

3. Dispositif selon la revendication 2, **caractérisé en ce que** la partie de liaison (20, 20a, 20b) est située dans une position décalée par rapport au centre de la longueur de la plaque.

4. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la plaque a une forme de « H » au de « h ».

5. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la plaque (2b) a au moins une ouverture longitudinalement allongée, dans lequel une première région est de largeur constante (s221 b) et une deuxième région est plus grande du point de vue de la taille (s210b) que la première région, ladite ouverture pouvant laisser passer les moyens de fixation d'un implant avant de coulisser pour amener lesdits moyens de fixation dans la première région.

6. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la plaque est reliée à au moins un implant par lesdits moyens de fixation aptes à maintenir ladite plaque sans empêcher la rotation de l'implant sur son axe de vissage ou sans empêcher un jeu spécifié de la plaque par rapport à l'implant ou les deux ; permettant ainsi de continuer à visser l'implant ou d'ajuster la position de la plaque ou les deux, que la plaque a été assemblée sur l'implant.

7. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit support de serrage (12) de l'implant (1, 1a) est mobile par rapport au reste de l'implant, le long d'un joint de type de cardan entre une partie de l'implant, désigné sous le terme de tête de vis (102) et une partie du support de serrage désignée sous le terme de tête de support (122), permettant ainsi de continuer à visser l'implant après que la plaque (2, 2a, 2b, 2c) a été assemblée sur l'implant, en faisant tourner le support de auteur d'un axe de support de serrage (d12), lorsque ledit axe (d12) forme un angle non nul (a) avec l'axe (d1) de l'implant.

8. Dispositif selon la revendication 7, **caractérise en ce que** la plaque (2, 2a, 2b, 2c) entoure le support de serrage (12, 12a) ou la deuxième extrémité (12a) de l'implant (1, 1a) au moins partiellement et sur un épaulement (32) de son support de plaque complémentaire (3), ledit support de plaque ayant du due l'implant, une surface concave (31) se présentant sous la forme d'une partie sphérique qui est supportée d'une manière complémentaire sur la surface externe de la tête de vis (102) de l'implant.

9. Dispositif selon l'une quelconque des revendications 7 et 8, **caractérisé en ce que** le support de serrage (12) a une première extrémité allongée (121) le long de l'axe de support (d12) et une deuxième extrémité portant la tête de support (122), ladite tête de support ayant une section transversale non circulaire ayant au moins une partie concave (120a) et comprenant

au moins une dimension plus importante qu'au moins une section transversale (s121) de la première extrémité du support de serrage (12) ; ladite tête de support (122) ayant premièrement une section à peu près partiellement circulaire le long d'un comprenait l'axe de support (d12), et étant deuxièmement agencée dans la tête de vis (102) à l'intérieur d'un logement dans lequel la surface interne (100) a au moins une partie en saillie (100a) coopérant avec la partie concave (120a) de la tête de support (122) pour empêcher la rotation du support de serrage (12) autour de son axe (d12).

10. Dispositif selon la revendication 9, **caractérisé en ce que** la surface interne (100) du logement (102) de la tête de vis a une forme à peu près complémentaire de la surface externe (120) de la tête de support (122).

11. Dispositif selon l'une quelconque des revendications 7 à 10, **caractérisé en ce que** le logement recevant la tête de support (122) a, du due ladite tête de serrage, une dimension spécifiée (s102) pour permettre au support de serrage (12), un jeu le long d'un angle spécifié (a) entre l'axe (d12) du support de serrage et l'axe (d1 de l'implant, sans que ledit support de serrage (12) ne puisse s'échapper dudit logement.

12. Dispositif selon l'une quelconque des revendications 7 à 11, **caractérisé en ce que** la tête de support (122) a une section transversale en forme d'étoile avec des extrémités arrondies, le long d'un plan perpendiculaire à l'axe de support (d12).

13. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les moyens de serrage (12) du support de serrage comprennent un filetage (123) coopérant avec un écrou (4) pour maintenir ou serrer la plaque (2, 2a, 2b, 2c) contre le support de plaque (3).

14. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le support de serrage (12) comprend au niveau de son extrémité opposée à l'implant, un évidement interne ou externe (124) pouvant recevoir un outil d'entraînement rotatif (51) et permettre ainsi le vissage ou le serrage de l'implant dans la vertèbre (0).

15. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la première extrémité d'ancrage osseux (11) d'au moins un implant (1, 1a) a un alésage longitudinal concentrique à sa surface externe, ledit alésage communiquant avec l'extérieur par au moins une ouverture de fusion osseuse (110) produite dans la paroi entre ledit alésage interne et surface, externe, permettant ainsi une fusion entre l'intérieur et l'extérieur de la substance en contact avec ladite première extrémité (11).

16. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la première extrémité d'ancrage osseux (11) d'au moins un implant (1, 1a) a deux filetages (111, 112) s'enroulant dans la même direction pendant le vissage de l'implant, et supportés respectivement par la surface externe de ladite première extrémité et la surface interne de l'alésage qu'elle comporte.

17. Dispositif selon l'une quelconque des revendications précédentes, en ce qu'au moins une ouverture de fusion osseuse (110) a la forme d'un trou oblong longitudinal.

18. Dispositif selon l'une quelconque des revendications précédentes, en ce que l'alésage de la plaque de support (3) à travers lequel le support de serrage (12, 12a) passe, est plus grand que le dernier, afin de permettre le jeu de la barre, au moins lorsque les moyens de serrage (4) sont serres sans serrage.

19. Procédé de préassemblage pour un dispositif selon l'une quelconque des revendications 1 à 18, **caractérisé en ce qu'**il comprend les étapes suivantes consistant à :

assembler le support de plaque (3) sur le support de serrage (12a, 12) d'un implant (1, 1a) ;
assembler l'écrou (4) sur le filetage (123) du support de serrage (12a, 12) dudit implant.

Fig. 1a

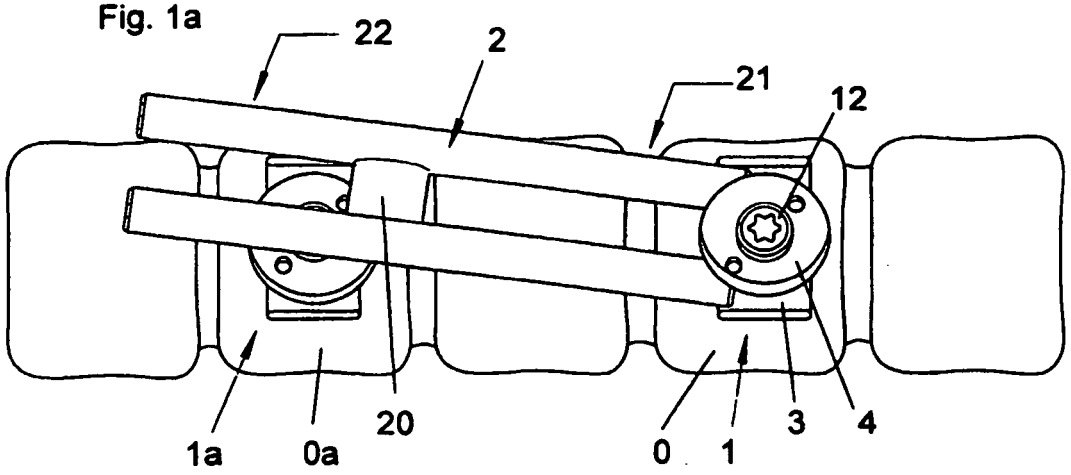


Fig. 1b

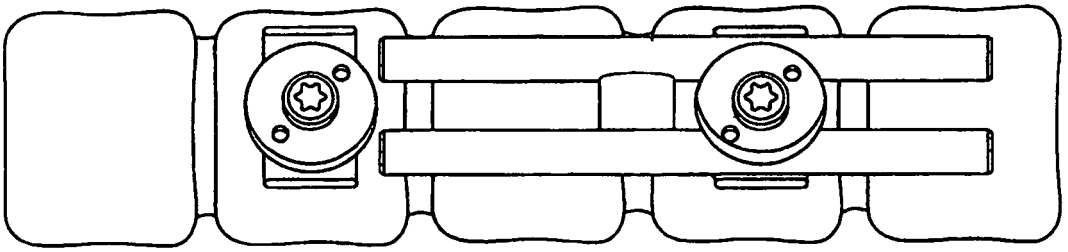


Fig. 1c

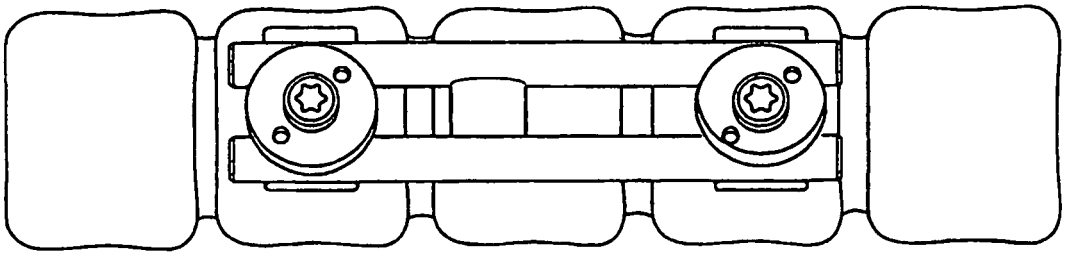


Fig. 2

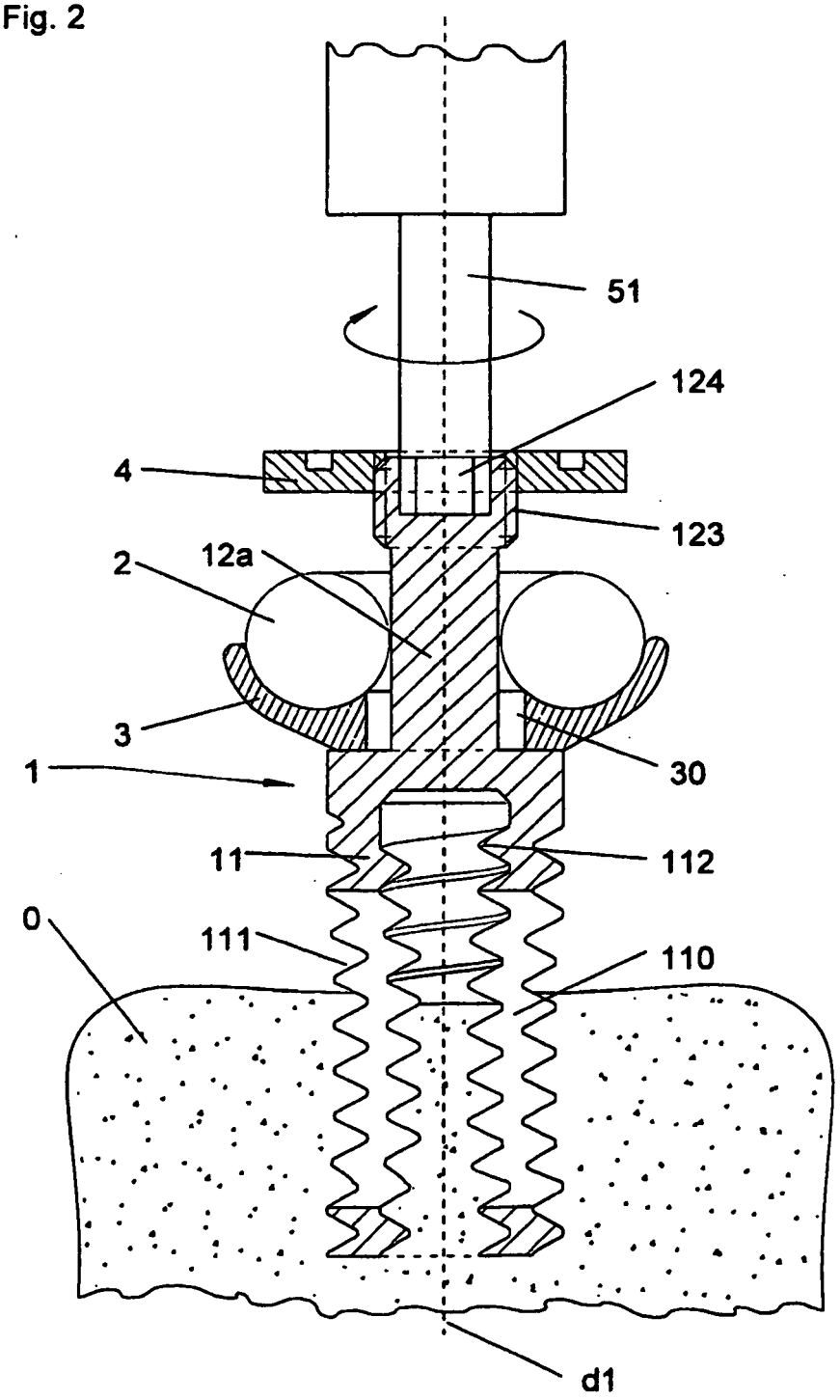


Fig. 3

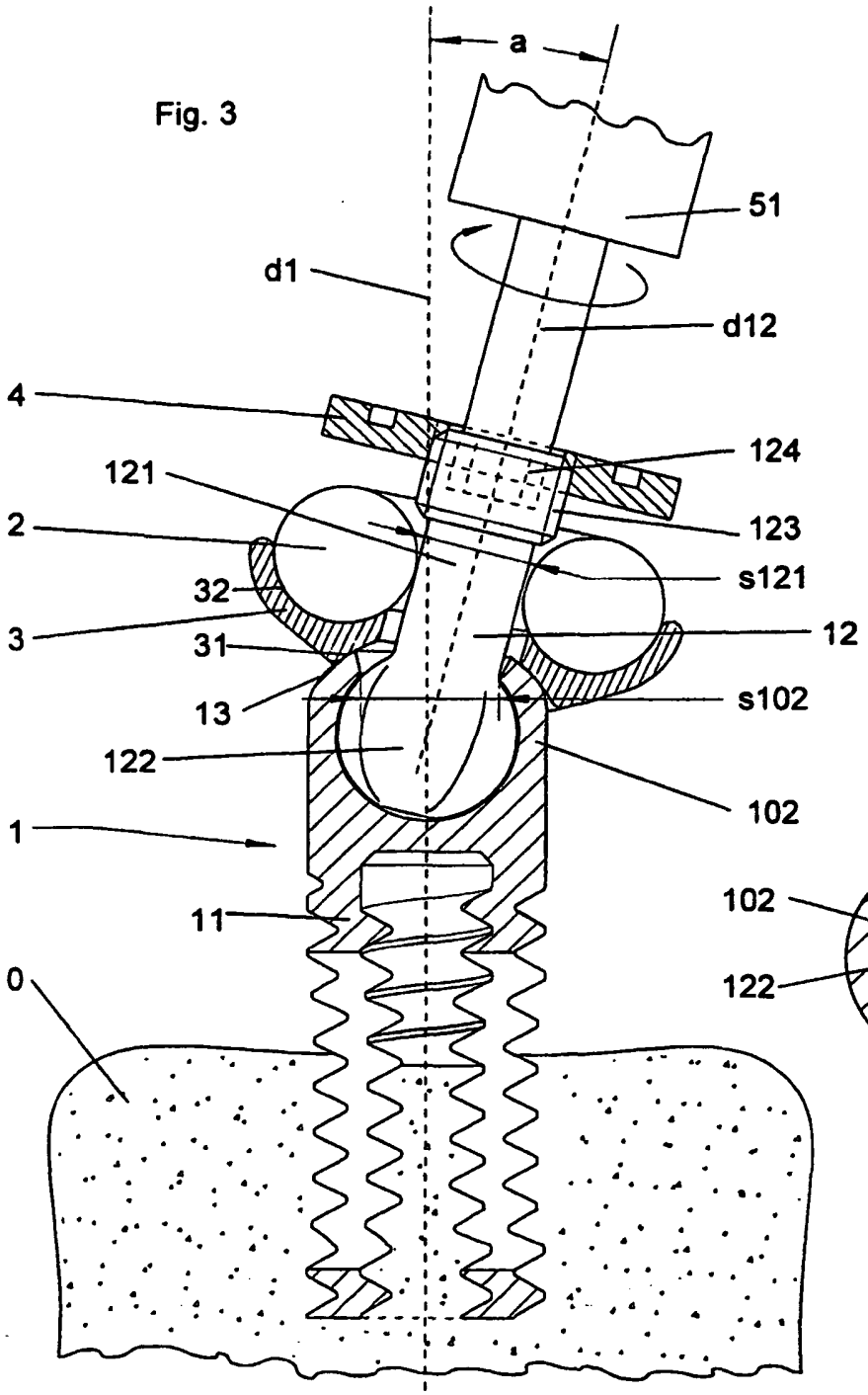

a
51
d1
d12
4
124
121
123
2
s121
32
3
12
31
13
s102
122
102
1
11
0

Fig. 3a

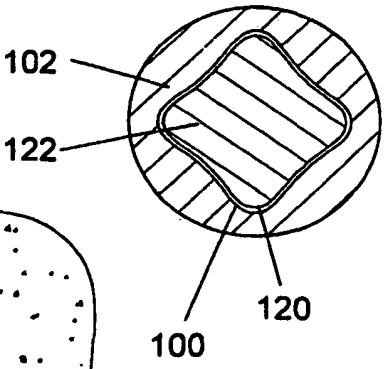

102
122
120
100

Fig. 4

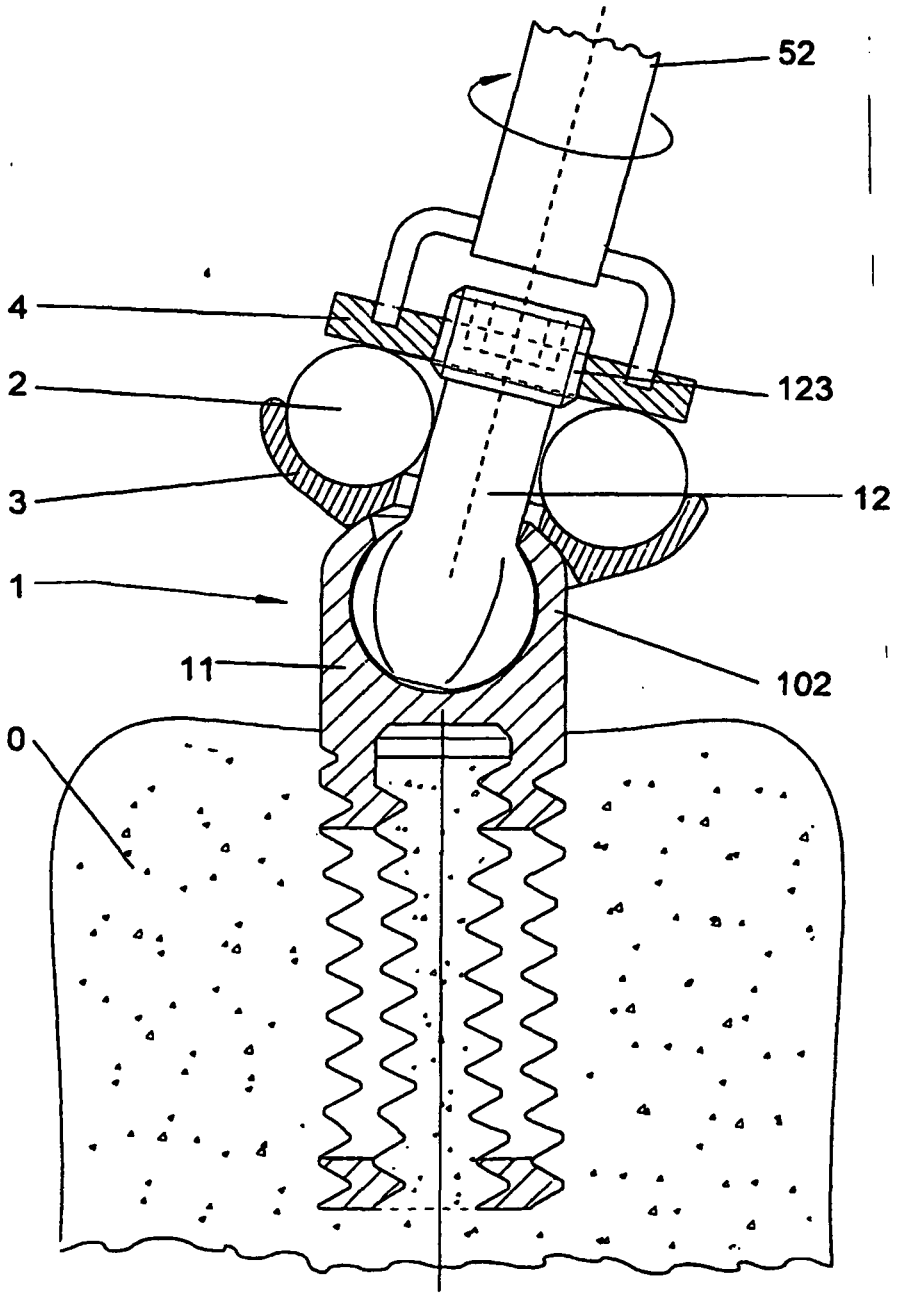


Fig. 5a

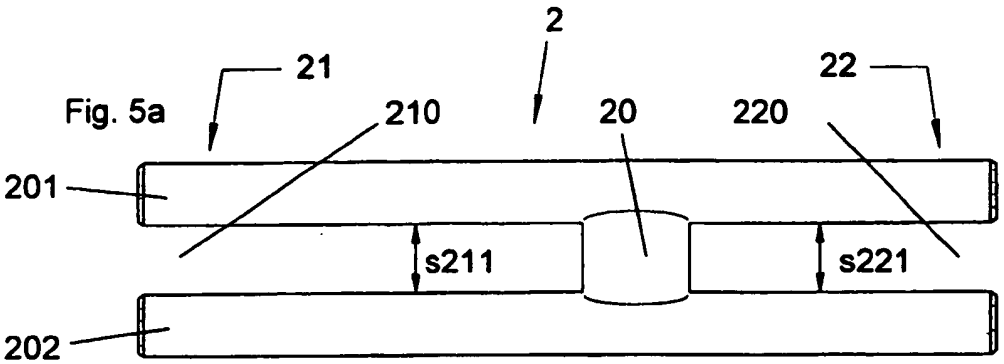


Fig. 5b

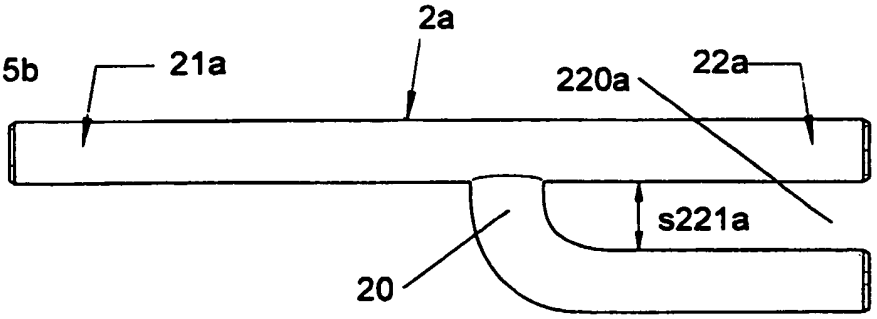


Fig. 5c

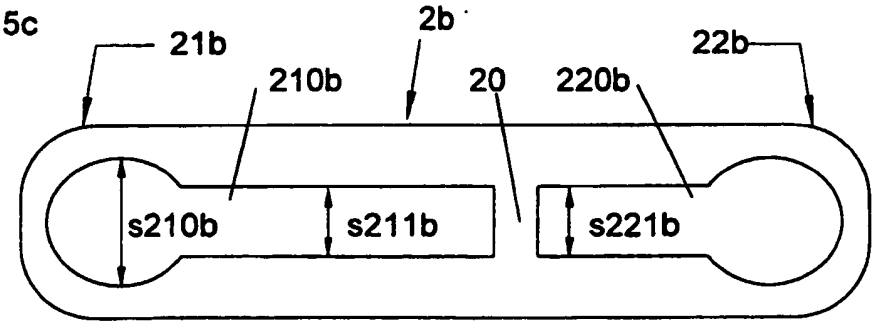


Fig. 5d

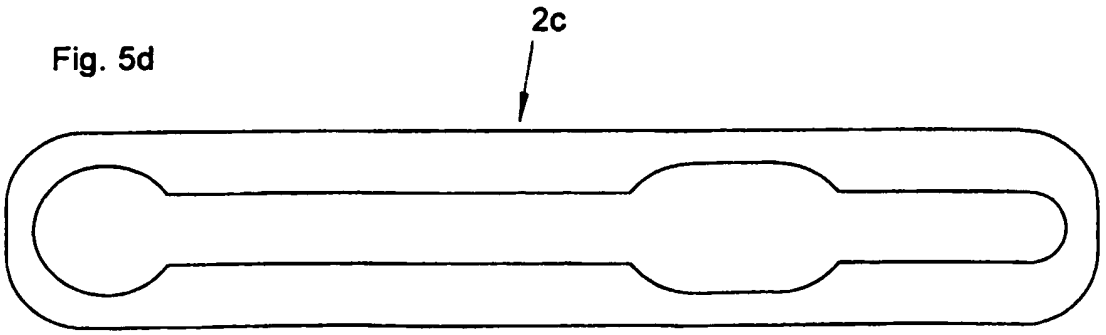


Fig. 6

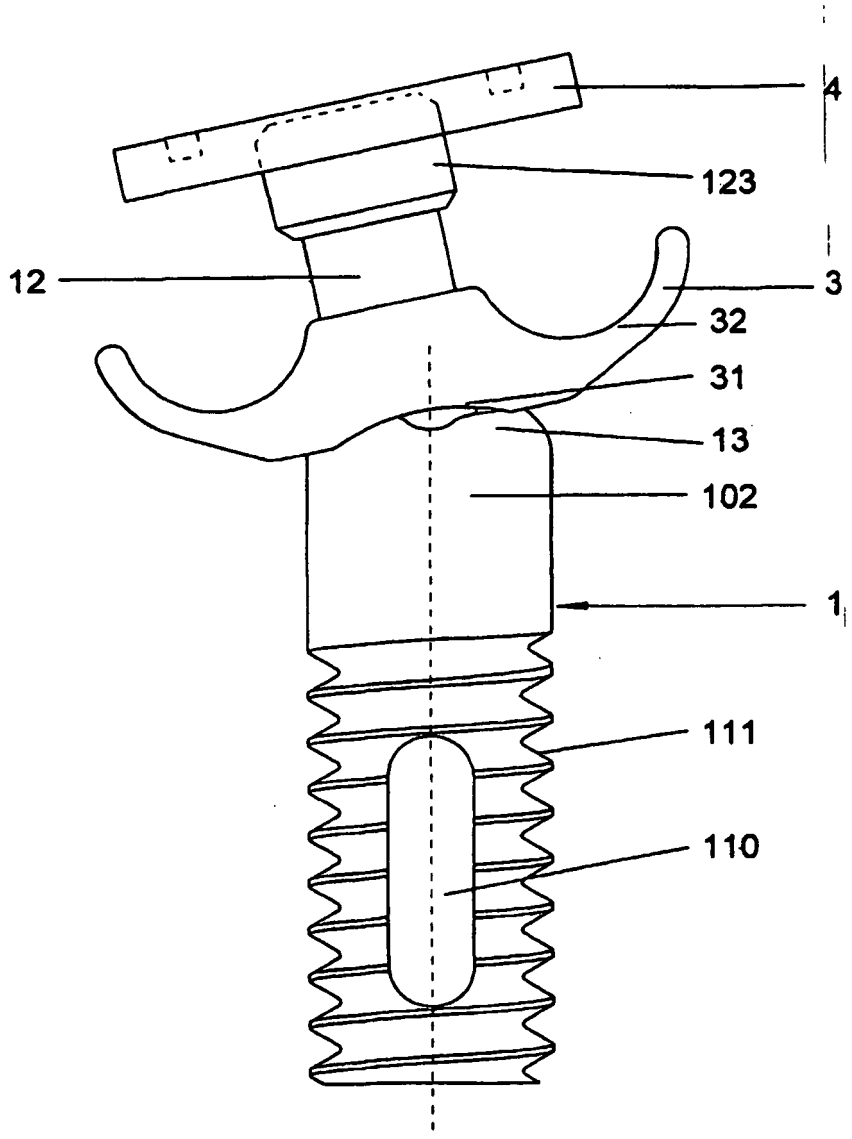


Fig. 7a

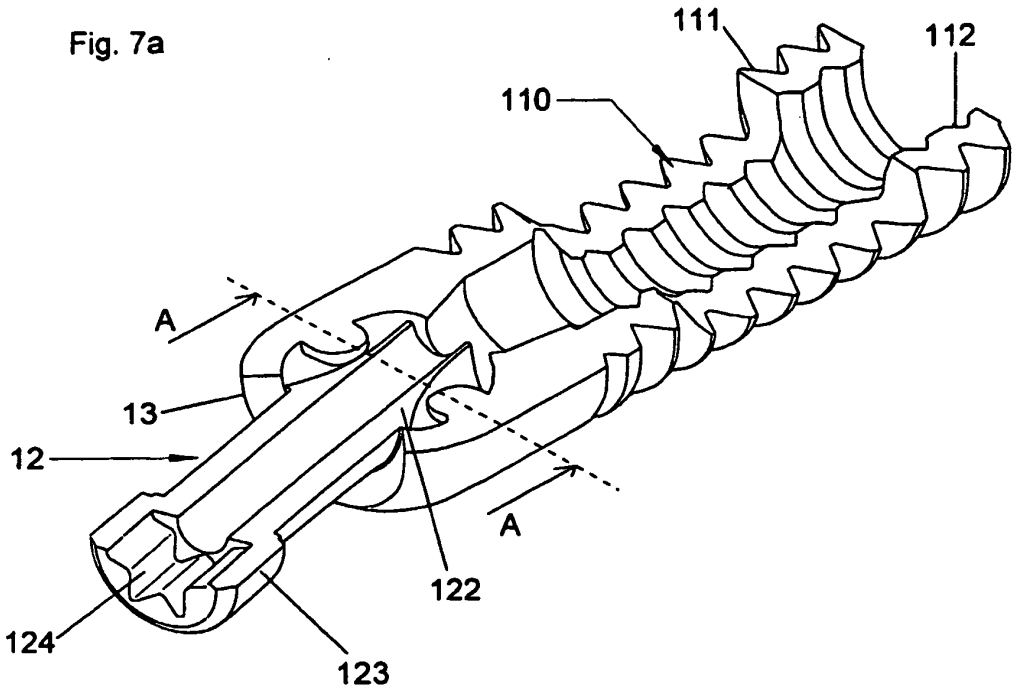


Fig. 7b

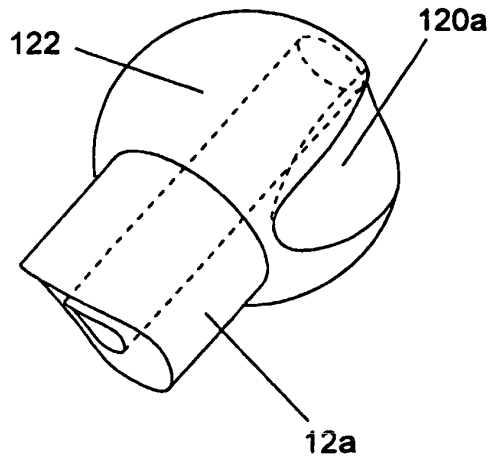


Fig. 7c

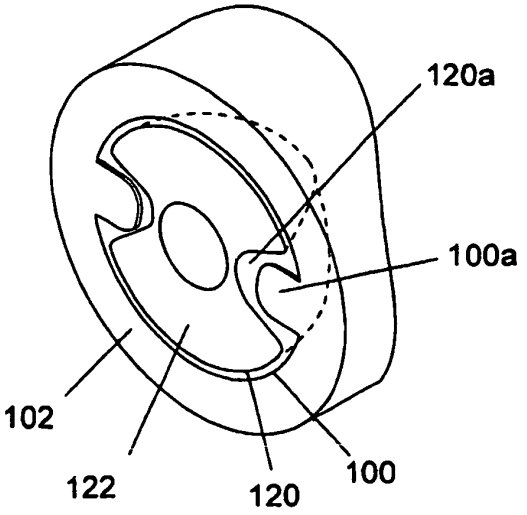
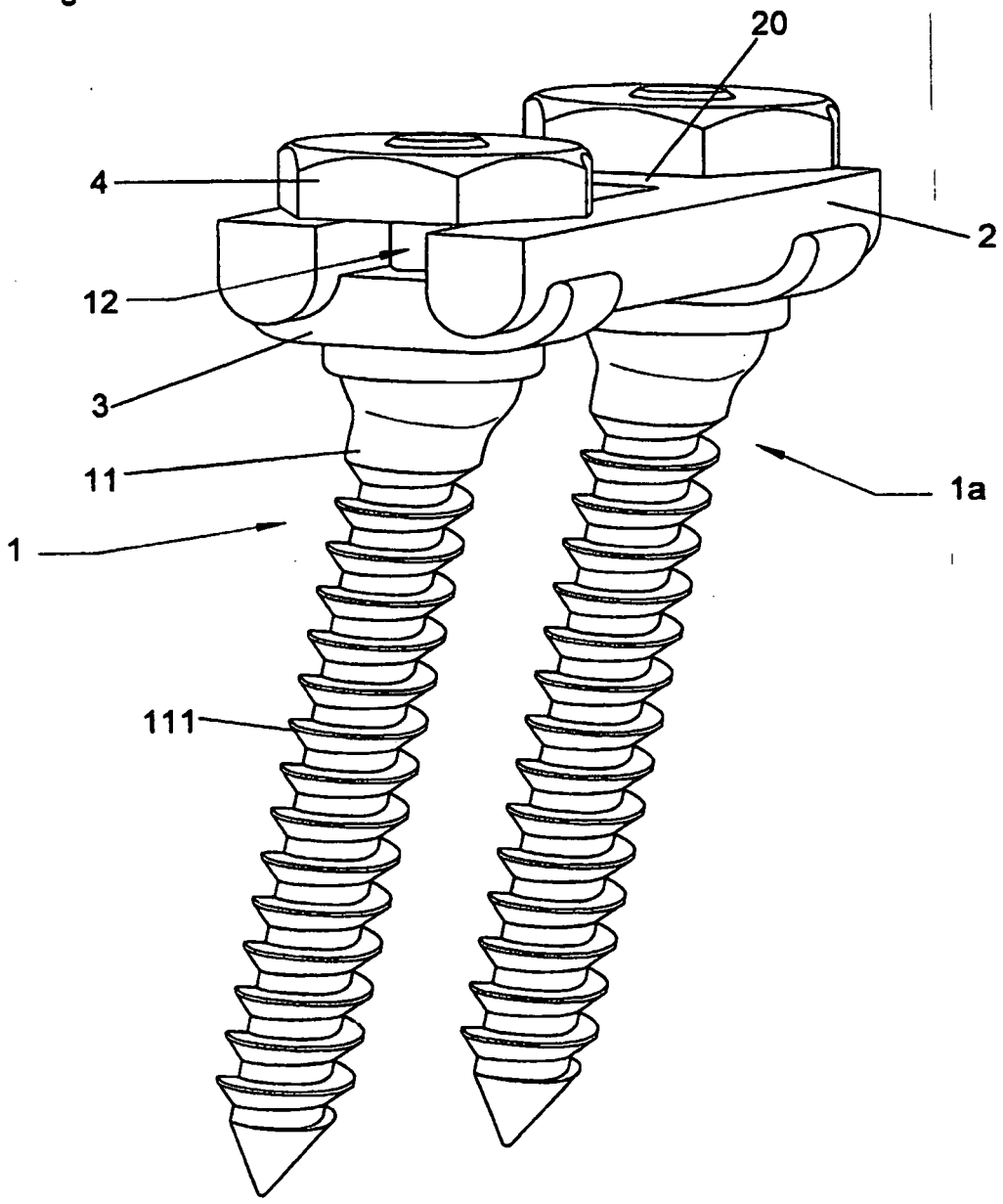


Fig. 8



REFERENCES CITED IN THE DESCRIPTION

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- JP 9098983 B **[0005]**
- WO 0101874 A **[0006]**